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BANDSAW WITH DOUBLE-EDGED BLADE AND OPPOSING THRUST ROLLERS

Related Application:

(0001)The present application is based in part on the Applicant's U.S. Provisional Patent Application No. 60/275,195 entitled "An Improved Bandsaw" filed on Feb. 20, 2001.

BACKGROUND OF THE INVENTION

(0002) Field of the Invention:

(0003) The present invention relates generally to the field of contour cutting bandsaw machines having the typical saw-toothed and flexible bandsaw blade, and particularly to bandsaws commonly used to cut wood and metal which require the use of blade guides to bracket a workpiece and prevent that blade from deflecting as it encounters the thrust of material being fed into it.

(0004) Statement of the Problem

(0005) Present and prior art blade guides typically have a thrust support bearing located behind the blade, i.e. the smooth edge of the blade opposite from the wood-cutting saw teeth as described by Duginske, et al. in Patent #4,920,846 dated May 1, 1990 or the metal-cutting saw teeth of the bandsaw described by Ohnishi, et al. in Patent #5,301,586 dated Apr. 12, 1994.

(0006) Bandsaw cuts involving sharp corners or acute angles require the operator to back the blade out of its cut and re-cut into that corner from another vector. This process is time consuming where very large workpieces are involved and difficult because the original cut leaves a rough surface inside the workpiece and the blade's trailing edge usually snags on the rough edges of its kerf. The blade cannot be forced backwards because pushing against the trailing edge of a prior art bandsaw blade pulls that blade out of its prior art blade guides, which resist thrust from only one direction; i.e. the direction of the cut. Without this rearward thrust support the blade is pulled out of the blade guide and subsequently off the blade's transport wheels and there is presently no blade guide that can resist the cutting action of a saw-toothed blade and provide thrust support while backing out of a kerf.

(0007) The thrust support bearings of prior art, being made of hardened steel, can't be used for this purpose because: 1, the support bearing would be destroyed by the blade's cutting edge repeatedly beating on it; and 2, the blade's sharp cutting edges would be dulled by the hard, blunt steel of the bearing.

(0008) Prior Art

(0009a) The term bandsaw has been used to describe any power tool whose blade can be loosely defined as forming a loop. For the purposes of this invention, therefore, a bandsaw shall be more narrowly defined as any machine whose flexible blade has a saw-toothed cutting edge and orbits a plurality of motor-driven transporting wheels and whose cutting edge is thereby stretched into a plurality of

straight lines connecting the outer arcs of said blade transport wheels, one open span of which constituting the cut path corresponding to the kerf through a workpiece. This narrower definition is offered here as an attempt to more accurately distinguish between the typical saw-toothed bandsaws of the wood and metal working trades from the more specialized, though still technically loop-bladed, bandsaws of; 1, the foam insulation trade which uses a tube-shaped blade with teeth to cut foam half-tubes for pipe insulation; 2, the electronics industry which uses hydrodynamic bandsaw blade guides to cut thin wafers out of crystalline substances; 3, the paper and meat processing industries which use knife-edged blades; 4, the stone cutting trades which use abrasive-coated blades; and 5, hobbyists and others who could use a wire-shaped blade to cut a variety of other softer materials.

(0009b) Because the blade of the bandsaw defined above is by definition thin and flexible it commonly requires support when pushed through a workpiece to prevent twisting, side-to-side deflection, rearward deflection, and forward deflection. It is therefore common in prior art to bracket a workpiece with a pair of anti-deflection devices called blade guides such as those described by Snodgrass in Patent #6,463,836 dated Oct. 15, 2002. The blade guides of prior art, however, do not support the blade against forward deflection because there is currently no mechanism capable of economically or practically supporting thrust against the cutting edge of a saw-toothed bandsaw blade. The problem arises out of the blade's propensity to cut anything in its path and the propensity of prior art thrust supports to dull saw teeth.

(0009c) A need therefore exists for a blade guide capable of supporting a toothed bandsaw blade against thrust directed at said teeth, thereby creating the possibility of a double-edged bandsaw blade and subsequent bi-directional bandsaw machine capable of cutting forward or backward simply by changing the direction of feed.

(0009d) Despite the apparent desirability of a bandsaw to simultaneously support thrust in both forward and rearward directions there is presently no known mechanism to provide this feature to any bandsaws of prior art other than the following references to elastomers in conjunction with bandsaw blades.

(0009e) In E.S. Smith's Patent #2,751,941 dated June 26,1956 an elastic idle roller is disclosed as providing thrust support to the smooth trailing edge of a tubular saw blade, which differs substantially from the object of the present invention in that it: 1, pertains to a tubular saw blade and is, therefore, neither flexible nor a typical bandsaw blade as defined above; 2, fails to provide thrust support against the saw teeth of the cutting edge, and 3, serves only to support thrust against the smooth non-cutting edge of said blade and offers nothing new to the prior art in terms of deflecting the cutting action of saw teeth nor preventing the dulling of said saw teeth in the process thereof.

(0009f) Miranti, Jr. discloses a double-knife-edged bandsaw blade in Patent #4,189,968 dated Feb. 26, 1980 which is configured as a Mobius strip in order to double the life span of said blade by presenting both edges to the workpiece from a single direction of cut. He makes no mention or provision for an opposable thrust support roller nor does Miranti teach a way or means to support thrust forces against a toothed saw blade. Though he claims a resilient coating on the side-to-side, or pinch, rollers he does not specify an elastic roller to support thrust.

(0009g) Harry C. Davis describes in Patent #4,295,263 dated Oct. 20, 1981 a double-edged tubular insulation saw blade with teeth on two edges of a looped blade which differs substantially from the general field of bandsaws in that; 1, his blade is

driven reciprocally, like a jigsaw; 2, his blade does not flex; 3, he neither needs nor offers blade guides; and 4, he neither needs nor offers opposing thrust support against the cutting edges.

(0009h) Bandsaw blades of prior art do not specify a blade with consistent uniformity of tooth length and in reality bandsaw blades are welded to a specified length with little regard for maintaining the uniform spacing of the teeth across said weld. While this common practice goes unnoticed in respect to prior art blade guides it becomes germane to the blade guide system set forth in the present invention and is expanded upon in the following description and drawings.

(0010) Solution to the Problem

(0011) The present invention provides a bandsaw blade with teeth on both edges and a means to guide the blade forward and rearward with equal ease.

(0012) Experimentation has shown that the teeth of a bandsaw blade will cut into a freely idling elastic roller only to the point at which the gullets (as described by Young in Patent #6,164,161 dated Dec. 26, 2000) of the blade contact the outer surface of the roller, as long as the teeth are consistently uniform in size and shape. Uneven teeth spacing or a weld joint that breaks the uniformity of spacing would break the pattern of interlocking teeth and indentations of the thrust roller and result in the rapid deterioration of said roller.

(0013) The essence of this invention lies in the tangential interface of blade teeth and roller indentations acting as a chain and sprocket. The teeth of the driven blade, consistently uniform in size and shape, intermesh with corresponding indentations in an elastic idle roller, causing said roller to rotate synchronously with said blade. The blade is supported parallel to the plane of the cut by elastic pinch rollers.

(0014) The bi-directional cutting system of this invention offers bandsaw operators a faster, easier way to cut architectural and industrial details and irregular shapes in a variety of materials. Additional advantages are: 1, elastic rollers are quieter, run cooler, and prolong blade life; 2, double-edged blades have a much tighter turning radius than single-edged blades; 3, double-edged blades track better on the rubber tires commonly used on blade transport wheels of prior art; 4, having teeth on the trailing edge of a cutting blade tends to clean the kerf, thereby reducing drag on the motor; and 5, time is saved setting up operations involving large workpieces. Furthermore, this system can be adapted to any existing bandsaw by simply and economically changing over to the blades and guides of this invention.

SUMMARY OF THE INVENTION

(0015a) An object of the present invention is to provide a bandsaw with opposing thrust support rollers continuously engaging a double-edged bandsaw blade.

(0015b) A further object of this invention is to provide a blade guide to enable existing bandsaws to cut forward or backward by simply changing the direction of material feed.

(0015c) Another object of the present invention is to provide thrust support against the cutting edge of a single-edged bandsaw blade in a prior art blade guide to facilitate backing prior art bandsaws out of ragged kerfs without pulling the blade off its transport wheels.

(0015d) These and other objects are accomplished by this invention's introduction of an elastic thrust support roller with circumferentially arrayed indentations corresponding to the teeth of a bandsaw in such a way that the driven blade imparts rotation to said idle roller tangentially and meshes with said blade synchronously to support thrust without dulling the blade.

(0015e) The bi-directional cutting system of this invention offers bandsaw operators a faster, easier way to cut architectural details and irregular shapes in a variety of materials. The bandsaws of this invention run quieter, cooler, and faster than prior art and they promote longer blade life.

(0016) These and other advantages, features, and objects of the present invention will be more readily understood in view of the following detailed description and the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

(0017) The present invention can be more readily understood in conjunction with the accompanying drawings, in which:

(0018) FIG. 1 is a top cross-sectional view of the preferred embodiment blade guide assembly.

(0019) FIG..2 is a front plan view of said blade guide corresponding to FIG. 1.

(0020) FIG.3 is a side plan view of said blade guide corresponding to FIG. 1.

(0021) FIG.4 is a fold-out view of the blade guide bracket of FIG. 1.

(0022) FIG. 5 is a front plan view of the thrust rollers showing pattern of circumferential indentations that form an inverse manifestation of a sprocket and chain relationship.

(0023) FIG. 6 is a side cross-sectional detail of a preferred embodiment of the thrust rollers and their relationship to the blade.

(0024) FIG. 7 is a side cross-sectional view of another possible embodiment of this invention being used to augment a prior art blade guide by adding a reverse

thrust roller to a bandsaw of prior art.

(0025) FIG. 8 is a side cross-sectional view of a possible embodiment of this invention being used to provide reverse thrust support to a common blade guide design for prior art single-edged blade.

DETAILED DESCRIPTION OF THE INVENTION

(0026) Fig. 1 shows a double-edged bandsaw blade 1 in cross-section as it would engage the blade guide assembly 10 in use, where pinch roller assemblies 2,2 support the blade 1 parallel to the plane of the cut or kerf to prevent sideways deflection and twisting while thrust roller assemblies 3,3 support the blade against deviation from fore-and-aft deflection from its travel path through the blade transport wheels of a typical bandsaw as described above.

(0027) FIG. 2 shows a front plan view of the pinch roller assemblies 2,2 which are comprised of a cylindrical, elastomer wheel 61, a radial bearing 51, and a shaft 41.

(0028) Fig. 3 shows a side plan view of the thrust roller assemblies 3,3 which are comprised of a cylindrical, elastic wheel 61, a radial bearing 51, and a shaft 41. For reasons of economy, simplicity, and interchangeability the thrust rollers 3 and the pinch rollers 2 are identical in composition but are hereafter referred to in terms of their function.

(0029) FIG. 4 shows a fold-out view of the blade guide bracket 30 in its preferred embodiment and corresponds to the blade guide assemblies 10 shown in FIGS. 1 through 3. Said blade guide bracket 30 serves to support pinch roller assemblies 2,2 and allow fine adjustments of same by means of elongated slots 37 in segment 34 of blade guide bracket 30. Likewise, blade guide bracket 30 supports the thrust roller assemblies 3,3 by means of elongated slots 39 in segment 35 of blade guide bracket 30. Segment 31 of blade guide bracket 30 serves as a flange to attach the blade guide assembly 10 to any bandsaw by means of bolt hole 36.

(0030) Fig. 5 shows the circumferentially arrayed indentations 15 of the thrust rollers' 3 outer surface 61 in detail and highlights the resemblance of these rollers to an inverse manifestation of a sprocket. It can be seen here where the outer circumference of said roller 3 between said indentations 15 constitute the primary source of blade support by reaching in between the teeth 11 and directly supporting the blade's gullet 12 which doesn't cut the elastic roller 3 during operation.

(0031) Fig. 6 shows a detailed cross-sectional front view of the blade's 1 tangential relationship to the thrust rollers 3,3 of this invention. Since the indentations 15 of the thrust rollers 3,3 are synchronized with the teeth 11 of the blade 1 and thrust force is distributed equilaterally along their interface, both attain a matching velocity, thus preventing friction or cutting of the elastic wheels 61.

(0032) Fig. 7 shows a possible embodiment of this invention wherein reverse

thrust roller assemblies 3,3 provide opposing thrust support to the double-edged blade 1 through the typical blade guides 72 and supported by thrust roller 3 support bracket 38 while side-to-side, pinch support is provided by said typical blade guide side blocks 4.

(0033) Fig. 8 shows another embodiment of this invention where thrust roller 3 provides reverse thrust support to a single-edged blade 81 in a blade guide 82 arrangement common to prior art bandsaws with a typical thrust support bearing 5 supporting forward thrust to the smooth edge of said blade. While this is not fully the bi-directional cutting system of this invention it does serve to prevent the single-edged blade 81 from coming off the transport wheels when backing out of a cut.

(0034a) Initial experiments with thrust rollers were conducted using skateboard/rollerblade wheels into which the saw blade was introduced by simultaneously adjusting the rollers together until the blade's teeth were completely enmeshed up to the gullets. This resulted in a useable reverse thrust roller in that the blade's gullets did support the blade against feed thrust for a time but the roller was eventually worn down by attrition. Close examination of the blade showed that the tooth length at the blade's weld was slightly longer and was incrementally wearing away the roller with every revolution of the blade. Finding a perfectly welded blade, the experiment was repeated with the result being that even aggressive pushing against the blade produced more than adequate support with little wear to the roller. Further experimentation with smaller rollers of similar design using the same method to form said rollers were also successful and showed more clearly that any roller of any material that can absorb, receive, or encompass the teeth while maintaining constant contact with the gullets would work as well, but a resilient interface is the preferred embodiment because of noise and friction concerns.

(0034b) It is envisioned that several means could be employed to utilize the teachings of this invention; i.e., the rollers could be pre-formed, cast, or molded of any material to fit a specified tooth shape, as long as the only points of contact with the blade are at the gullets. One major advantage to "wearing-to-fit" elastic rollers as described above is the economy and ease with which they can be made to fit any blade.

(0035) The above disclosure sets forth a number of embodiments of the present invention. Other arrangements or embodiments, not precisely set forth, could be practiced under the teachings of the present invention and as set forth in the following claims.